BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

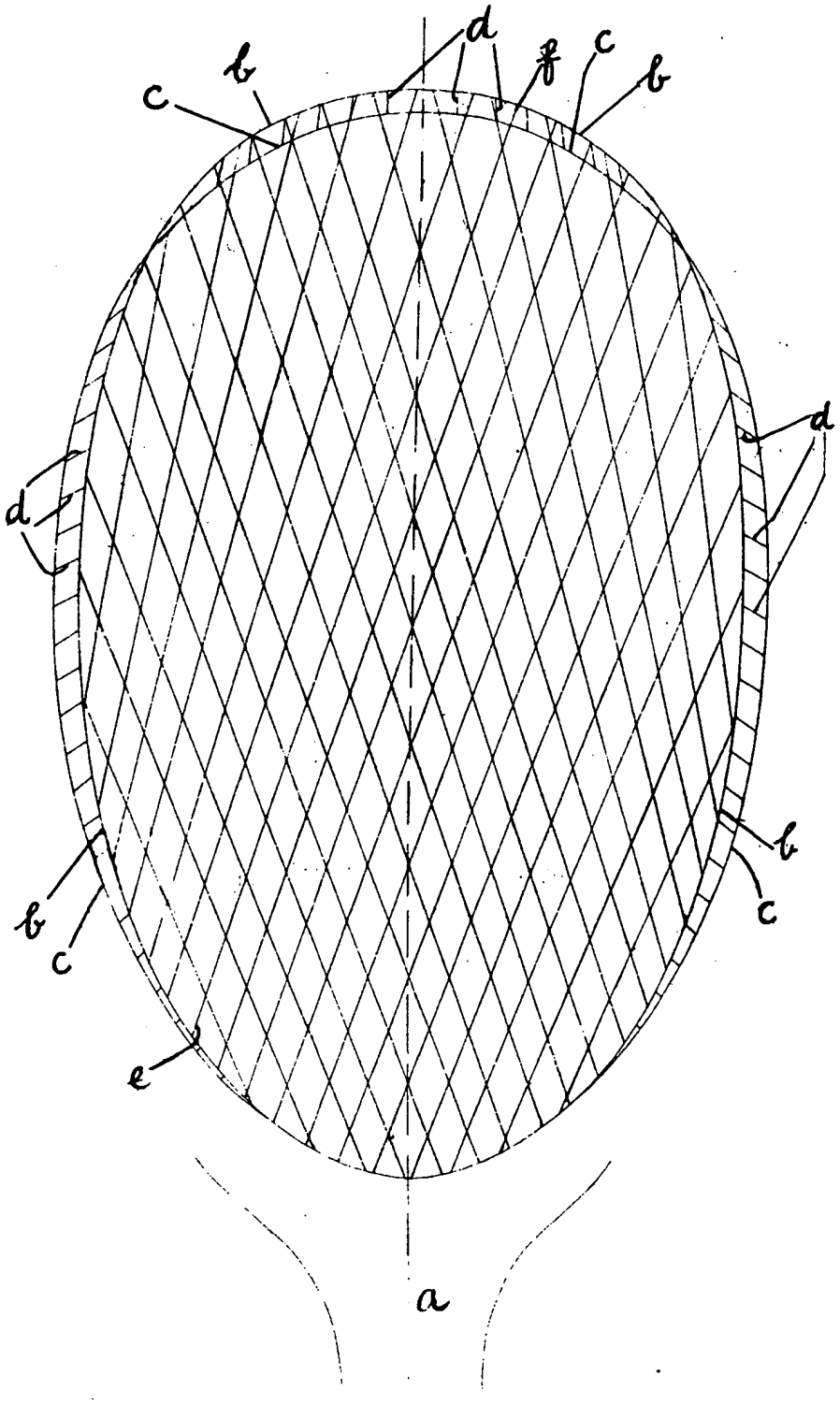
Dec 3-1928

by Claremont.

95

287,583 COMPLETE SPECIFICATION

1 SHEET



Charles & Read Ltd Photo Litho

PATENT SPECIFICATION

Application Date: Sept. 25, 1926. No. 23,654/26. 287,583

Complete Left: July 25, 1927.

Complete Accepted: March 26, 1928.

PROVISIONAL SPECIFICATION.

An Improved Games Racquet.

I, CLAUDE ALBERT CLAREMONT, of Studio House, Rosslyn Hill, Haverstock Hill, in the County of London, B.Sc., Pedagogist, a British subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to racquets for games such as tennis, badminton, etc. Racquets are usually made with a wooden rim and strung with gut, but racquets are also made with rigid metal rims, and also with strings made of metal wire.

The wire-stringing has certain advantages over gut-stringing such as durability, and constancy of tension notwithstanding atmospheric changes, but it loses the desired resiliency afforded by gut-stringing. Efforts have been made, by twisting, or in other ways manipulating wire, to attain such resiliency, but not with satisfactory results.

The object of this invention is to enable a racquet to be made with stringing of metal wires, and attain the desired resiliency better than has heretofore been done, and a further object is to effect an improvement in gut-strung racquets, or racquets strung in other ways.

According to this invention the rim is made of springy steel or other suitable resilient metal or material, capable of yielding, under applied force, in the plane of the racquets. The required resiliency in the case of stringing of steel wires or other non-stretchable material is obtained by causing a distortion of the rim from its normal shape against the reaction of its own elasticity, involving of necessity that the blade shall contract in one or more directions with consequential bulgings or extensions of diameter in one or more other directions.

The rim may be of various cross-section shapes consistent with obtaining the desired resilience and affording the required strength and weight. The strings can be made of wires of steel or other suitable metal, or gut or other suitable material. If made of steel wires or other non-stretchable material the strings are so arranged that (when struck, as by a ball) the combined effect is to cause the rim to contract in one or more directions, as predetermined, against the reaction of its own elasticity, without inhibiting the consequential bulgings or extension in some other direction or directions which would in itself prevent the contraction in the first mentioned direction or directions. For example, in the case of an elliptical or quasi-elliptical rim, the stringing might be arranged to cause the longest diameter of the rim to shorten and permit the smallest diameter to extend.

In the case of a stringing made of gut or other material affording the desired resiliency, the resilient rim although not required for the purposes of attaining resiliency, is useful for the purpose of permanently maintaining the desired tension of the gut.

It will be realised that in the stringing with steel wires or other non-stretchable material it is essential that the distance between the points of attachment of each string (except perhaps in some areas of the blade of the racquet where it would be immaterial) shall not be increased by the predetermined permitted distortions of the rim, or such strings would inhibit the desired distortion.

Although it might be determined to so construct the stringing that the rim would contract on any one or more diameter, with consequential extensions, for the purpose of facilitating the elucidation of this invention, so far as concerns the stringing with non-stretchable material, I propose to assume that it is determined to construct a racquet with a quasi-elliptical blade, the longest diameter being in line with the handle, and that the resiliency is to be attained by a contraction of the longest diameter with consequential extension of the shortest diameter.

Of course one set of strings more or less parallel to the longest diameter covering the whole area of the blade of the racquet would meet the required condition, that the distance between the points of attachment of any given string should not be increased by the predetermined permitted distortion of the rim; but it is essential, in order to secure other required qualities of a racquet, that one set of strings shall

cross, and perhaps interlace with, another set, and if another set were arranged across such a set as above described, the second set would inhibit the desired distortion of the rim.

It will be realised that, whatever the nature of distortion determined, many strings not parallel to the diameter of "contraction" would meet the required condition as to the distance of the points of attachment, and that in such a racquet as described strings crossing or at an angle to the longest diameter and connecting points within a limited arc from the ends of the longest diameter would meet the said condition. If however the whole face of the racquet described were strung with strings parallel to such strings some of the strings would for a certain area of the blade remote from the centre, and to a greater extent the more remote from the centre, fail to comply with the said condition.

It may be found in practice that the failure to meet the condition in such areas of the blade would have such a slight effect that the result aimed at by this invention would nevertheless be practically attained.

The failure however to attain the said condition can be wholly, or for all practical purposes, removed by departing from the parallel relationship of the strings of each set, and arranging them to an extent fan-wise, the degree of divergence from the parallel depending very much on the shape of rim adopted, the nature of the distortion permitted, and the magnitude of the inclination of the main body of strings to the diameter of "contraction".

As an example of a racquet made according to my invention I may construct a racquet as follows:—

I make a racquet having a quasi-elliptical blade, the rim being of steel and having a suitable amount of elasticity in the plane of the blade, and the longest diameter being in line with the handle. The portion of the rim adjacent to the handle and extending a short distance on each side of the handle is rigid.

Two sets of strings cross one another, each at an inclination to the longest diameter.

The strings of each set are quasi-parallel to one another and are approximately inclined 60° to the longest diameter, but as they proceed from their respective "handle end" attachments they spread fanwise, the respective positions of each being determined to ensure (as far as possible) that the distance between the points of attachment of each string shall not be increased by the desired distortion of the frame.

In a stringing so arranged the mesh would appear as practicable, equal square or diamond-shape spaces the diagonals of which lie more or less parallel to the line of the handle.

Preferably in all cases the strings are under a permanent spring tension exerted by the rim, that is to say, when the stringing is effected the rim is slightly distorted from the position it would assume if there were no strings, though not to such an extent that it is at the practical limit of its flexibility.

The two ends of a band or strip of metal forming the rim might be continued down to form part of the handle, the whole length or part of the length of the handle, and between the blade and the handle there may (if desired) be a space and (if desired) this space may be wholly or partially occupied by strengthening or weight giving devices. A device may also be provided to enable adjustment of the tension of the strings.

Dated this 24th day of September, 1926.

CLAREMONT, HAYNES & Co.,
Vernon House, Sicilian Avenue,
Bloomsbury Square, London, W.C. 1,
Applicant's Solicitors.

COMPLETE SPECIFICATION.

An Improved Games Racquet.

I, CLAUDE ALBERT CLAREMONT, of Studio House, Rosslyn Hill, Haverstock Hill, in the County of London, B.Sc.(Eng.) London, A.C.G.I., Pedagogist, a British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to racquets for games such as tennis, badminton, etc. Racquets are usually made with a wooden rim and strung with gut, but racquets have also been made with either rigid or spring metal rims, and also with strings made of metal wire. In some racquets the strings are arranged to cross one another diagonally of the rim.

The wire-stringing has certain advantages over gut-stringing such as durability, and constancy of tension notwithstanding atmospheric changes, but it loses the desired resiliency afforded by gut-stringing. Efforts have been made, by

twisting, or in other ways manipulating wire, to attain such resiliency, but not with satisfactory results.

The object of this invention is to enable a racquet to be made with stringing of metal wires, and attain the desired resiliency better than has heretofore been done, and a further object is to effect an improvement in gut-strung racquets, or racquets strung in other ways.

Hitherto in all racquets heretofore made the desired resiliency has been sought to be obtained from the strings and the method of stringing has been such as to inhibit distortion of the rim in the plane of the racquet. This invention is based on a new principle and seeks to obtain the desired resiliency wholly or partly by means of distortion of an elastic rim in the plane of the blade.

Hence the invention consists in the combination of a particular method of stringing hereinafter explained, and a rim pliable in the plane of the racquet.

According in this invention the rim is made of any suitable material including steel and wood capable of yielding to the required extent, under applied force, in the plane of the racquet. In the case of stringing of steel wires or other comparatively non-stretchable material and in a less degree in the case of gut stringing to obtain resiliency reliance is placed on a distortion of the rim in the said plane against the reaction of its own elasticity, involving of necessity that the blade shall contract in diameter in one or more directions with consequential bulgings or extensions of diameter in one or more other directions the stringing being arranged not to check the yielding of the rim to attain the required resiliency. The resilient rim apart from the purpose of affording resiliency is useful for the purpose of permanently maintaining the desired tension of the gut. The rim may be of various cross-section shapes consistent with obtaining the desired resilience and affording the requiredstrengthand weight. The strings are so arranged that (when struck, as by a ball) the combined effect is to cause the rim to contract in one or more directions, as predetermined, against the reaction of its own elasticity without opposing the consequential bulgings or extension in some other direction or directions, which would in itself prevent the contraction in the first mentioned direction or directions. For example, in the case of an elliptical or quasi-elliptical rim, the stringing might be arranged to cause the longest diameter of the rim to shorten and permit the smallest diameter to extend.

It will be realised that it is essential that the distance between the points of attachment of each string (except perhaps in some areas of the blade of the racquet where it would be immaterial) shall not be increased by the predetermined permitted distortions of the rim, or such strings would oppose the desired distortion.

Although it might be determined to so construct the stringing that the rim would contract on any one or more diameters, with consequential extensions in other directions, for the purpose of facilitating the elucidation of this invention, so far as concerns the stringing, I propose to assume that it is determined to construct a racquet with a quasi-elliptical blade, the longest diameter being in line with the handle, and that the resiliency is to be attained by a contraction of the longest diameter with consequential extension of the shortest diameter.

Of course, one set of strings more or less parallel to the longest diameter covering the whole area of the blade of the racquet would meet the required condition, that the distance between the points of attachment of any given string should not be increased by the predetermined permitted distortion of the rim; but it is essential, in order to secure other required qualities of a racquet, that one set of strings shall cross, and perhaps interlace with, another set, and if another set were arranged across and normal to such a set as above described, the second set would oppose the desired distortion of the rim.

It will be realised that, whatever the nature of distortion determined, many strings not parallel to the diameter of "contraction" would meet the required condition as to the distance of the points of attachment, and that in such a racquet as described i.e. elliptical and contracting on longest and bulging on smallest diameters, strings crossing or at an angle to the longest diameter and connecting points within a limited arc from the ends of the longest diameter would meet the said condition. If however the whole face of the racquet described were strung with strings parallel to such strings some of the strings would for a certain area of the blade remote from the centre, and to a greater extent the more remote from the centre, fail to comply with the said condition.

It may be found in practice that the failure to meet the condition in such areas of the blade would have such a slight effect that the result aimed at by this invention would nevertheless be practically attained.

The failure however to attain the said condition can be wholly, or for all prac-

tical purposes, removed by departing from the parallel relationship of the strings of each set, and arranging them to an extent fan-wise, the degree of divergence from the parallel depending very much on the shape of rim adopted, the nature of the distortion permitted, and the magnitude of the inclination of the main body of strings to the diameter of " contraction ".

The degree of divergence need not be constant throughout the stringing, and can even reverse in direction from side to side of the set of strings.

As an example of a racquet made according to my invention I may construct a racquet as follows:—

I make a racquet having a quasi-elliptical blade, the rim being of steel or wood and having a suitable amount of elasticity in the plane of the blade, and the longest diameter being in line with the handle.

Two sets of strings cross one another, each at an inclination to the longest diameter.

The strings of each set are quasi-parallel to one another and are approximately inclined 30° to the longest diameter but as they proceed from their respective " handle end " attachments they spread fanwise, the respective positions of each being determined to ensure (as far as possible) that the distance between the points of attachment of each string shall not be increased by the desired distortion of the frame.

Preferably in all cases the strings are under a permanent spring tension exerted by the rim, that is to say, when the stringing is effected the rim is distorted from the position it would assume if there were no strings, though not to such an extent that it is at the practical limit of its flexibility.

In the case of a steel rim the two ends of a band or strip of metal forming the rim might be continued down to form part of the handle, the whole length or part of the length of the handle, and between the blade and the handle there may (if desired) be a space, and (if desired) this space may be wholly or partially occupied by strengthening or weight giving devices. A device may also be provided to enable adjustment of the tension of the strings.

The accompanying drawing shows diagrammatically an example of my invention.

The diagram illustrates the principle on which this type of racquet is to be strung. *a* is the handle, *b* is the inside edge of the frame in what may be called its " normal " position. *c* is the position of the same edge after it has undergone a hypothetical distortion.

The lines marked *d* join points on line *b* to the new positions of such points, when the racquet frame is distorted to the position *c*.

It will appear shortly how the strings are placed in order that pressure upon them, which for the purpose of this illustration is considered to be at right angles to the plane of the racquet face, will produce necessarily distortion of the above type, although of course, not necessarily so much distortion as that shewn in the diagram. In the practical designing of such a racquet the frame could actually be subjected to such distorting forces as would enable two actual positions of the inside edge to be drawn. The designer having obtained a drawing of these two positions proceeds to explore them with dividers or other convenient measuring instrument and is able to find a position for each string, such that its two extremities are either closer together when the frame is in position *c*, than when it is in position *b*, or remain the same distance apart in the two positions. The essential is that no distance between points of attachment of any string should tend to get longer owing to the said distortion, unless for some particular reason such as will be indicated later. In the diagram shown it will be found by measurement that all the strings correspond to the above conditions. The positions shown are not the only ones which the several strings could occupy. If we imagine the lower end of a string, i.e. that nearest the handle, as fixed, the upper end could lie anywhere in a certain zone without failing to comply with the above mentioned conditions. For example, considering string *e*, *f* in the diagram let us suppose the end *e* to be given a fixed position, the designer then has to choose the position of the end *f* within the following limits (*a*) a point at which the string would lie parallel to the longitudinal axis and (*b*) a point on the other side of the longitudinal axis, beyond which when the distortion occurs, the points of attachment would get further apart. With regard to limit (*a*), it is evident that if all strings lie parallel to the longitudinal axis the strings could not cross, and therefore the position would not be practicable. At the same time the more nearly they approximate to this position the greater is the change produced in the length of such lines as *e*, *f* for a given amount of distortion of the frame. As the other extreme position (limit *b* is approached) the change in the length of the line *e.f* produced by a given amount of distortion gradually decreases, until the critical position is reached in which the diminution in the length of

e.f is zero and after this it changes to an increase. The more nearly *f* approaches this critical position the greater force will have to be applied at right angles to the string to produce a given amount of distortion of the type illustrated in the diagram.

The effect of one string alone crossing the longitudinal axis at an angle would not of course be to produce this particular type of distortion, but the effect of two complete sets of such strings crossing one another and crossing the longitudinal axis symmetrically would be such as to produce this distortion. If similar principles be applied in choosing the position of every such string a combination may be made in which the strings severally approach as nearly as the designer wishes to the critical position which exists for each one, as just described in the case of *e. f*, and by going nearer to such critical positions he obtains the result that a greater force has to be applied at right angles to the racquet face in order to produce a given amount of distortion. Thus he has it in his power to make the racquet face more and more rigid up to a point at which the direction of distortion would alter and no longer follow the longitudinal axis.

The racquet rim in its normal position, i.e. after stringing, may or may not be in a state of strain due to a preliminary distortion maintained by the initial tension of the strings.

The designer may find it advantageous to depart in the case of certain strings from the rules for determining the angle of such string above laid down, e.g. he may find it advantageous to place certain strings at such an angle that the distance between the points of attachment tends to be increased in length by the distortion shown on his drawing as a result of preliminary tests made upon the rim. Such strings would then have the effect of opposing such distortion, and thus of strengthening the rim against distortion in its own plane in such way as may be desirable, without inhibiting it altogether.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A games racquet characterised in that the rim is pliable in the plane of the racquet to afford wholly or in part the required resiliency, and the stringing is arranged not to oppose the yielding of the rim to attain such resiliency.

2. A games racquet as claimed in Claim No. 1, the required resiliency being afforded wholly by the pliability of the rim and the strings being of comparatively non-stretchable material.

3. A games racquet as claimed in Claim No. 1, the required resiliency being afforded in part by the pliability of the rim and the strings being of a longitudinally resilient material.

4. A games racquet as claimed in any of the preceding claims in which the strings are stretched between such points that on a contraction of one or more diameters and consequential extension of one or more other diameters, the distances between the points of attachment of each string are not increased.

5. A games racquet as claimed in any of the preceding claims in which two sets of strings cross one another at inclinations some or all of which are determined with reference to the ascertained behaviour under distortion of the actual type of rim to be used.

6. A games racquet as claimed in any of the preceding claims the strings comprising two sets of strings inclined to the axis of the handle, crossing one another and some or all of the strings of each set being related to one another fanwise.

7. A games racquet as claimed in any of the preceding claims in which the majority of the strings are stretched between such points that on a contraction of one or more diameters and consequential extension on one or more other diameters the distances between the points of attachments of each such string are not more distant while one or more of the remaining strings are arranged to oppose the free distortion of the rim.

8. As a process in the making of a racquet as claimed in any of the preceding claims ascertaining the points of attachment of some or all of the strings by distorting a rim pliable in the plane of the racquet.

9. As a process in the making of a racquet as claimed in any of the Claims Nos. 1 to 7 distorting a rim by means of pressure along a diameter, making a drawing in which the rim under normal tension and the rim as so distorted are superimposed, ascertaining therefrom the points of attachment, in accordance with this invention and stringing the rim accordingly.

Dated the 25th day of July, 1927.

CLAREMONT, HAYNES & Co.,
Vernon House, Sicilian Avenue,
Bloomsbury Square, London, W.C. 1,
Applicant's Solicitors.